## EUROPEAN SPACE DEVELOPMENTS

After a year and a half of negotiations, an organizational basis has been established for a cooperative Western European program for the exploration of outer space. The convention about to be signed by the 11 participants* sets up a European Space Research Organization (ESRO) to develop scientific satellite experiments and to conduct related research. ESRO is patterned after the highly successful European Center for Nuclear Research (CERN) established ten years ago by virtually the same countries for cooperation in the nuclear field.

In addition, six** of these countries are also members--along with Australia--of the European Launcher Development Organization (ELDO), established a month ago for the development of space-launching vehicles. Its program was inspired in part by Britain's desire to salvage some of its investment in an abandoned military missile. ELDO has the drawback that it would produce a vehicle considerably less advanced than existing US vehicles. It could also contribute to the development of military capabilities by individual countries in the missile field. Nevertheless, ELDO's members consider their cooperative program necessary in view of the high costs involved and to enable Western Europe to participate fully in the evolution of the space age.

*Belgium, Denmark, France, West Germany, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom.*

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### Development and Organization of ESRO

Informal discussion of European space cooperation began in early 1960, but formal negotiations date from an 11-nation conference at CERN headquarters in Geneva that fall. This conference appointed a preparatory committee headed by Britain's Sir Harry Massey and charged it with drafting concrete proposals for an organization, research program, and supporting budget. These proposals were largely complete by last January, but conclusion of the necessary convention has been delayed for several months by difficulties over voting rights, distribution of costs, and location of the various ESRO installations.

The top policy authority of ESRO will be the council composed of two representatives from each of the member countries; a secretariat seated in Paris will provide executive direction in the organization. The major ESRO establishments will be the space technology center (ESTEC) in the Netherlands, at Delft; a space center (ESDAC) at Darmstadt, West Germany; a space laboratory (ESLAB) in Italy; and a launch range (ESRANGE) near Kiruna, Sweden. Additional tracking and telemetry stations will also be constructed to supplement such well-developed facilities as Britain's Jodrell Bank. ESTEC, the most important of the new ESRO installations, will be staffed by an estimated 800 people engaged in applied research

in space technology and responsible for the development and manufacture of instruments for rockets and satellites.

ESRO Budget and Research Program

ESRO expenditures are expected to total $78 million in the first three years and $122 million in the next three, with a ceiling limit of $306 million for the first eight-year program. As in the case of CERN, financial contributions have been levied in proportion to national income, but no member country is expected to contribute more than 25 percent of the total budget.

ESRO planners expect this relatively modest budget to finance a program of space activities of progressively increasing complexity and sophistication. During the initial three years of operation, in which the various installations, laboratories, and tracking stations would be set up, space experiments would be restricted to investigations of the upper atmosphere utilizing both instruments and biological specimens. These probes--from the Kiruna range--would carry payloads averaging 100 pounds to altitudes of 90 miles. Small satellites in close orbits--100 to 500 pounds to altitudes of 300 miles--would be attempted in the fourth year; space probes and larger satellites up to 5,000 pounds would follow in the sixth year; and a lunar satellite is planned for the seventh.

Purpose and Origin of ELDO

The ESRO convention provides for no specific source of propulsion equipment for these experiments, and the organization is ostensibly free to choose from whatever equipment is available in Europe or offered by the US or the USSR. The European Launcher Development Organization was founded, however, on the expectation that ESRO would choose to rely on ELDO-developed vehicles, at least for the latter phases of its initial space program.

ELDO is largely the brainchild of Britain's Minister of Aviation Thorneycroft and was conceived in the aftermath of the Macmillan government's decision in April 1960 to abandon its Blue Streak ballistics missile program after an estimated expenditure of $182,000,000. Thorneycroft proposed that the Blue Streak and the UK's Black Knight become the basis for a "European" space vehicle. This scheme was turned down by the ESRO planners, but the Blue Streak was subsequently accepted after the French were mollified by the substitution of a French rocket for the Black Knight. Paris and London jointly sponsored the conference in early 1961 from which the ELDO convention eventually emerged.

ELDO Organization and Program

The ELDO program as finally agreed to calls for the development by mid-1965 of a three-stage rocket, the first stage of which will be the Blue Streak, the second stage the French Veronique, and the third a new rocket to be developed by West Germany. Italy has been allotted the design, development, and construction of the test satellite; Belgium will supply the guidance system; and the Netherlands will direct the work on a long-range

telemetry link. Test firings of both the modified Blue Streak and of the completed multistage vehicle will be from the Woomera range in Australia, which was constructed for the Blue Streak and on which little if any further work will be required.

London has had to agree to pay one third of the estimated $200,000,000 cost of this development program, the remainder being financed by the other participants in proportion to their national incomes. This presumably reflects in part the comparatively limited opportunities for subcontracting in the conversion of the Blue Streak, although the Italians in particular have pressed hard to participate in every phase of the program. Both Italy and West Germany strongly opposed having ELDO bound too firmly to the Blue Streak project and successfully insisted on a review after two years to "take account of the progress made and to consider the possibilities for the future."

Security Considerations

From the beginning, the ELDO project has caused the US concern that it would contribute to the wider dissemination of missile technology and to the development of military capabilities in this field.

As drafted last fall, the ELDO convention provided merely that the organization should not concern itself with military applications of space vehicle launchers and stated specifically that each member should have the right to procure "for any purpose of its own" equipment jointly developed by ELDO. Largely as a result of US remonstrances, however, the charter was modified to provide that ELDO will be concerned only with peaceful applications of launching equipment, which may be procured by the members for peaceful purposes only.

The US also sought provision in the ELDO charter against release of information to Communist-oriented countries, but such a "cold war extension" was objected to by a majority of the participants, and the most that could be agreed to was an article providing that information could be released to other countries only by unanimous consent of the members. However, the UK has offered the US a private undertaking to veto any such release to Communist-oriented states and has also agreed that information obtained from the US in the development of the Blue Streak and related specifically to missile-delivery capability will not be given to other ELDO members.

Nevertheless, ELDO provides no organizational control over the application of ELDO-acquired information to the development of independent missile forces.

The ESRO-ELDO Potential

In assessing the ESRO-ELDO potential, it must be borne in mind that both organizations will complement existing and in some cases well-established national space programs. The value of the cooperative approach will therefore be judged in part by the extent to which it succeeds in discouraging wasteful duplication.

So far as ESRO is concerned, most observers consider it is

making a promising beginning in this respect. ESRO intends to create a scientific forum to discuss, guide, and coordinate national and joint space efforts; to provide central research, technology, and management facilities to supplement national capability; and to encourage interchange of thought and experience by visiting and research fellowships. Thus, ESRO is geared in considerable part to the creation of a solid, scientific basis for a space program, taking into consideration that the available talent is both dispersed and comparatively inexperienced.

The joint space explorations contemplated by ESRO, although not expected to yield significant scientific data initially, are similarly geared to the development of experience for more sophisticated experiments. ESRO is therefore taking a "do-it-yourself" approach, but it has nevertheless welcomed NASA advice (e.g., concerning cost estimates and tracking stations), and it would like to have some sort of liaison with the USSR. According to the secretary of the preparatory committee, ESRO has no intention of competing with either the US or the USSR but still feels there are many areas in which the Europeans can make a useful contribution.

ELDO Reservations

Since NASA is prepared to sell ESRO the Scout and the Thor, and will cooperate with ESRO in the use of the Atlas for experiments of mutual interest, the decision of the Western Europeans to proceed with the development of an independent European launching system appears largely motivated by political, commercial, and prestige considerations.

The ELDO planners have variously contended that the organization would (1) advance European economic and political integration; (2) provide European technicians and industry with much-needed experience in missile technology; (3) eventually supply European space programs with a booster less expensive per unit than any comparable American vehicle; and (4) preclude permanent European reliance on American-produced launchers. ELDO's promoters have especially stressed that an independent launching capability is necessary before European countries can enter the communications satellite field.

While most of these arguments have been questioned by ELDO's critics, the organization is in keeping with the trend toward a revivified, more self-reliant Europe. Even those Europeans who initially were strongly opposed to ELDO have been impressed by the argument that the Europeans cannot afford to see the space race permanently monopolized by the US and the USSR. American offers of launching equipment have not, for example, convinced the Dutch, who have said that Europe can develop needed technology only if the US goes further and agrees both to European manufacture of American rockets under license and to active European participation in the development of new rockets.

Against these considerations must be balanced the fact that ELDO, in developing a vehicle which may be entirely suitable for European purposes, will be covering ground already passed by the US and the USSR. Cost estimates, moreover, have probably been set too low, and American experts question that the European vehicle will be available, as ELDO anticipates, at half the unit cost of similar American equipment. Finally, given the advance which American and Soviet boosters are expected to be making in the meantime, these experts also question that ELDO's vehicle--with roughly twice the weight-lifting capability of the Thor-Agena B--will have the useful lifetime of five years which ELDO expects.

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